NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Speech

by

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P R O C E E D I N G S

MR. : We're happy for you to be with us, and we look forward to hearing what you have to say about leadership in exploration today.

MR. BEGGS: Thank you very much. First, I am delighted to be here. I am honored and pleased. It's pleasant to come to England in Spring, and it's also very pleasant to come and discuss some of the past accomplishments and management challenges that we have undertaken in the space agency in the United States.

Indeed, you can say in the very true sense that the accomplishments of NASA are really worldwide accomplishments, which we drew upon almost all of the scientific resources of the world when we managed and accomplished our major programs.

I am very pleased to join you. We've heard of this Center and your work, and its significant contributions. We, in NASA, like to encourage the kind of exchange that I hope to have with you this afternoon, because it is an exchange between business and government and between business and the academic world that has made our system work. I have more to say about that.

We at NASA are involved in trying to manage technical resources in the midst of a very large competitive challenge in the world, and, of course, in the midst

of what is a very rapidly changing situation with respect to the technologies that we utilize in doing our major system work.

It is kind of interesting with the backgrounds that two of the NASA -- two of the six NASA administrators were submarine officers, and that is sort of an inside joke in NASA.

Tom Payne (phonetic), who came right after Jim left -- Jim, incidentally was the second administrator, not the first, but Tom was a submarine officer and then I came on here at this past year, another submarine officer.

We are -- we did, however, along the way require the skills of a pilot, so we feel a little more confident to deal with the world of space than maybe anyone else having sailed through several different milieus on the earth, and both Tom and I still have the ambition of flying in shuttle, of getting up into space one of these days.

More than a century ago one of your great prime ministers, Benjamin Disraeli said, "The secret of success is constancy to purpose.", and that is true of individuals as well as nations, and it certainly was true of America's space endeavors, because what we were trying to do back in the early '60's was to do something

that had never been done before, that would -- indeed, was considered to be undoable at the time. It required very strong leadership, major motivation, careful strategic planning, and, of course, a national commitment, a commitment of national resources that was truly unprecedented in our previous history.

Of course, I am alluding now to the Appolo program, which was the (inaudible) period of NASA, and was probably the world's greatest attempt to put together both government, industry and academic resources to do a project that was larger than anything we had ever undertaken before.

It was expensive. It had implications across our society which are still unfolding, and, of course, it did put us in the forefront of the space age.

We have realized a number of very important benefits from the research we did as a consequence of that program. The communications satellite industry, one of the fastest-growing industries of the world, the meteorological program which guarantees up-to-date and accurate weather forecasting worldwise, many subsidiary benefits in medical electronics and medical monitoring equipment -- and far out fall outs in industrial gasses, solid state electronics, computer sciences and many others that are too numerous to mention.

When we undertook it, however, those were yet on the distant horizon, and they were not the objective of the program. The program started primarily because of the beginning of the space race in which you all recall.

The United States and the Soviet Union had -- drawing on their resources and technologies which had been created in World War II, jet engine rocket, the rocket engine, the radar equipment, electronic -- advanced electronics and various and sundry other disciplines, which had been developed during the war and were available after the war made it obvious to those who were thinking about what would come after, that the exploration in space was now possible, as, indeed, the United States announced in the mid--50s that a celebration of the International Geophysical Year -- that we would launch a fall satellite into orbit for the purpose of doing some monitoring of the earth's surface.

The Soviets, not to be outdone, announced that they, too, would launch a satellite in the IGY; however, -- anticipated by some period of time, because on October 4, 1957, 25 years ago, they launched what we all remember as Sputnik. It was a shock to us in the United States because it indicated the Soviets have a lead, and the lead was significant.

The President and his counsellors met to take a look and see what we could do that would be a project of enough significance and enough complexity and enough difficulty that we could out-distance the Soviets and challenge them in an area where we felt they could not compete on as favorable terms as we.

Because we felt we had the wherewithall to do a major project of high complexity, we chose the project of going to the moon. There had been a great amount of planning that had gone on prior to that time.

It was not a decision taken without having thought through all of the implications. NASA is an outgrowth of the old National Advisory Committee for Aeronautics.

The NACA was created in the United States in 1950 primarily because the United States could not produce a competitive military aircraft in World War I.

The NACA was truly an advisory committee structure, but as time went on they realized they must have research resources so they created three research centers -- the great center of Piney, Virginia which is still the mother center of the agency.

A propulsion center at Louis in Cleveland and a center at Ames. The location of those centers is primarily around cheap power, to provide power for

the wind tunnels.

Those centers did the initial planning that enabled us to make the commitment to Appolo, and by 1960 they were ready with the necessary planning and the necessary background to allow Jim Webb to have become the Administrator in 1960, to go to the President and tell him that we could, indeed, carry out the mission successfully.

He was supported in that by a number of fairly important people including Bob McNamara who was then, as you know, the Secretary of Defense and Lyndon Johnson who was the Vice President.

Johnson was a great friend of a number of people who knew Webb at the time, knew Webb very well at the time because they worked with him. Men like Jim Kerr (phonetic) and others who have worked with Webb when he was in Oklahoma working for Kerr McGee (phonetic).

They backed him up. They said if Jim Webb says it can be done, it will be done, and I think that is an important point to make in the undertaking of a major venture of that type.

The commitment was taken really on a man's word. The basis for the commitment was that they trusted the integrity of man and they realized a sufficient plan has been laid so as to enable its success.

So it was that the then-President, John Kennedy went to the -- before Joint Session of Congress and announced that he intended to challenge the world and on May 25, he said, "I believe this nation should commit itself to achieving the goal before this decade is out of landing man on the moon and returning him safely to earth.".

"No single space project in this period will be more impressive to mankind or more important for the long-range exploration of space, and none will be so difficult or expensive to accomplish."

That, indeed, was the basis for the decision. None would be as difficult or expensive to accomplish, and in short, we went right at the Soviets in as difficult a project as we could find and, indeed, it paid off because in a matter of about four years we had moved ahead of the Soviets and we were doing much more impressive, much more complex, much more technically advanced work.

Interestingly enough in a political environment the sense that this was an important undertaking -- and there was virtually no opposition to it in spite of the fact that the project had been budgeted at that time in the order of $20 billion; in those days quite a lot of money.

The Congress throughout the project backed NASA

and NASA Administration to a degree that I think is unprecedented in our system.

It was over an eight-year period -- Nine individual budgets, because as you know in the United States we budget year-by-year, and nine times this project had to be defended before the Congress, and nine times the Congress backed it up -- did not cut any part of it, backed it up fully with funding required, and, indeed, the Congressional leadership involved in the thing.

Men like Olin Teague of Texas, who was Chairman of the House Committee, and Cliff Anderson (phonetic) of New Mexico was the Chairman of the Senate Committee -- became really great promoters of the program.

So we -- Webb realized that if he was going to make the thing go, that the organizational style and the organizational form they had to adopt had to be extremely flexible, and he knew that what he had was a very effective technical team.

The men who came out of the old NACA to which were added the Frederick Von Braun (phonetic) team down at Huntsville, Alabama, who had been brought over after the war and worked on rocketry for the Army -- they were brought over in tact, and became, what eventually became the Marshall Space Flight Center, which is responsible for the rockets.

Then two other centers were added -- one, of course, on the coast of Florida as the major watch facility, which took a piece of what was an Air Force Base at Cape Canaveral in Florida -- renamed it subsequently the Kennedy Spacecraft Center.

Then the Johnson Center now in Houston, which was to be the center for the detailed planning, the training of the astronauts and the mission control, and it was built up primarily as a control center, with a large amount of simulation equipment and other equipment to bring the training of our newly acquired test pilots to an IP (phonetic).

Once that organizational structure was put in place Webb realized that there would be as we went along a number of problems that occurred which required changes. As he put it in order to manage a project of this size, it is necessary to have all of your people willing and available to do any job to which they are assigned, and during the course of the project, during eight years in which the project was active, there were at least five reorganizations in the agency.

Men were moved in new assignments. They often added to their assignment. We reorganized several times at the headquarters level in order to better use our management talent, and as crises occurred such as the fire,

we reorganized once again in order to reemphasize the safety aspects of the program. In short it was a very, very flexible management style.

When I came to the agency in '67 the agency was once again under a reorganization. I took from -- perhaps one of the most enjoyable jobs in the agency, since I had the advanced research and technology side, and had the old centers, the Langley, Lewis and Ames Center reporting to me, but that particular organization had just come into being when I arrived.

The other hallmark of the organization was the top management, itself. Webb had acquired Hugh Dryden (phonetic) who was the last manager of the NACA. Hugh became his deputy, and he brought down Bob Semens (phonetic) out of MIT and Semens became the general manager of the agency.

That triumvir operated as a single head. In short, no decisions were taken unless all three were a party to them, and, indeed, any management instruction or any communication on the subject of the programs was signed by all three men.

It was discussed by all three men. As we moved into the procurement side of the program, and, of course, the decision was made earlier that the program would rely on the business community, the industry, to do the manufac-

turing work.

We did set up a couple of very specialized manufacturing activities to take care of the high risk -- high risk from the point of safety, but the bulk of the work was done in existing industrial plants.

Those procurement decisions were as well taken by all three men, and any procurement matter over $5 million, which in the science program we were running was a relatively small amount of money -- had become before the three men for the final decision.

They operated together on those points.

As a consequence though of doing the business through the industry the agency never grew very large. Although 35,000 is a large number of people, we were perhaps, managing a work force of about half a million, people -- the Appolo program.

It was not a huge agency either in size of personnel or in size of facilities. We maintained sufficient facilities so as to keep our expertise, our technological edge to the point where we can understand any problem that we ran into in the manufacturing process or in the process of operations, but we did not do all of the detailed construction work within the agency.

Today the agency operates -- still in that way. We're down to about 21,000 now on a budget of about

$6 billion, so you can see if it were an industrial organization with a $6 billion turnover, we would probably have four or five times that number.

Though we do our work through the industry and this was very important, I think, in the success of the program -- early on Jim Webb felt that we should involve the academic community to the fullest extent.

Over 80 universities were brought into the program. They were, at first, reluctant. They felt that they might be being dragged into something that would utilize resource, divert their attention from their primary function.

When that (inaudible) -- but bit by bit they were brought into the program effectively, and contributed very significantly to the success of the program. In the process of doing that we did a favor for the nation in that we trained some 5,000 students to the PhD level, financing them fully.

Reconstructed some $50 million worth of new research facilities on the campuses and provided them with up-to-date equipment, and we put them into some new research fields that they would not otherwise have been in, and, indeed, I think that much of the progress that the United States has made in the electronic area, in computer sciences and allied fields is to a large extent

traceable to that effort of bringing those students along in the advanced work.

We did, in those days, require the bringing into the program of a number of foreign scientists as well. At first that was difficult, but Webb, in the early days, managed to get from the Congress the authority to go out and make agreement on his own with foreign governments, which was unusual in the American scene, and the State Department quite naturally opposed it.

Jim Webb, having been an Undersecretary of State at one point in his career, understood that problem very well, and he was able to shepherd the legislation through the Congress.

As a consequence of that particular aspect of the program we have made agreements with over 100 countries, and we drew on the expertise of almost all of the advanced countries in getting them to help us with very specialized tasks.

It helped immeasurably. The research centers and the industry that we attracted required that we construct a very specific form of management, what is now known as Program or Project Management -- was brought to its fulfillment in those days.

It started with the evaluation process and evaluating proposals from industry, and it worked its way

all the way through until we flew.

It required a very strong discipline in the agency in order to get them to focus upon the things that were truly important. Early on the agency was accused a number of times of not having evaluated properly proposals from the industry so Webb, Dryden and Semens developed a very, very disciplined approach to the evaluation of proposals from the industry and a very, very disciplined approach to the grading and selection process.

As I mentioned earlier it finally culminated by coming before the three of them. The result of that, I think, is that we did end up with a very competent set of industrial partners.

We put into place a management system that enabled us to stay on top of those contractors every step of the way. We had a detailed review process. In short it was management in detail, and it required that all of the managers both at headquarters and at the center level devote a lot of time to reviewing progress of the contractors.

They spent a lot of time at the contractor's plants, and they spent an enormous amount of time in reviewing in Washington and Johnson in Houston the progress of those contracts against the schedule and against the costs.

This finally resulted, I believe, in a form of management which has continued to serve the agency well even unto this day. We have sent over to -- actual books that was generated in that period, which describes the process that was developed in that period, I think, very well, if you can wade through some of those, very well describes some of the difficulties that the agency went through in getting that to work.

Having brought the industry and the universities on board and having gotten ourselves to a point where we felt the program would do very well, we had the fire.

It was a tremendous shock to the agency because we felt that we had covered every base, and that there was not room in the program for a mistake. It was a very bad mistake, indeed. It set the program back about a year while we straightened out our safety, the safety features of the program, and it resulted in a very major reorganization of the agency.

The fire, I think, illustrates one of the features of the management of a complex project like this, that you probably cannot foresee. As a matter of fact there have been a number of comments made on this, that in undertaking a project of the magnitude and scope of Appolo, that sooner or later you're going to make a

mistake. It is almost inevitable in the management process.

Webb always felt that the fire could have been anticipated, that the problem could have been anticipated, and I think in my studies of it, I would agree with him, that that problem could have been anticipated, that if it had not been that problem, I think we would have encountered another.

The problem is getting your management over a long period of time, an eight-year period to continue to devote the detailed attention to every aspect of a complext project.

It is something that -- what we look back on as being -- as presenting an unanswered question. Webb always put it -- how do you create a perfect management system. I would put it -- make it a little different than that. "How do you keep people's attention directed to a task over a long period of time when it looks like it is going routinely.".

The program had gone extremely well prior to the fire. Everything seemed to be marching along in a steady state, and was being routinized, and then all of a sudden we have problems, and the problem set us back.

As I said earlier the agency reorganized and we went on the success, but it did do funny things to our

psyche in those days.

The last thing I'd like to touch on -- one other thing, and then close my remarks. About 1965 or 1966 or so the United States' attention was being directed towards urgent social needs.

There was an attack on the Agency to the point that the money that was being spent perhaps should be better spent on earth.

Of course, all the money is spent on earth, but nevertheless, the felling is --

(Laughter.)

The feeling was that it should be spent for more urgent social purposes and not for this wildly extravagant space venture.

So we set out to try to show at that time what the fallouts of the program were, and it was the first time the agency had thought a good deal about what it was that was going to come out of the program in addition to performing that splendid objective of landing on the moon.

An Office of Technology Utilization was created, and they were charged with the responsibility of going out and taking to industry the technical developments that came out of the overall space program. We have fortunately in NASA an architect for that in that the

old NACA had had a long-standing relationship with the aeronautical industry and the aeronautical technology and, indeed, NASA picked that task up, and it was well known how the system worked as between the aeronautical industry and NASA's research centers.

There was very intimate relationships that had been established over the years. The industry came in and used our centers. As a matter of fact they relied on the wind tunnels as their prime source of testing apparatus.

We had not devoted a great deal of attention to how you spin off things from the space program into other industries, and so we developed a program to try to advertise, if you will, the technology progress we were making as we moved through the Apollo program, and as time went on to the related programs of planetary exploration, and near earth space science.

That program was very successful, and it goes on until today. We have identified literally thousands of applications. I touched on a few of them. There are perhaps 20 or 30,000 examples of products which have grown out of specific NASA research over the past 20 years, so it was very successful.

It continues very successful, but it is still attacked. It is attacked then and now on the

basis of -- one two bases.

One is that really you ought to leave it up to the industry and government money should be spent for urgent social needs, and the second attack was that it is really not cost-effective, and that usually comes from the economists.

In the United States, indeed, I think in the western world has been in the last 25 years, certainly since the war, the development of financial techniques which (inaudible) major cost benefit.

They go by various names. In the United States, and I am sure here in Europe, there are discounted cost flow analyses, cost benefit ratios, the attempt to quantify the result of research before you do the research.

It can't be done. It is an illusion. and I think -- in the United States we're beginning to understand that again. As a matter of fact in my old school, which is probably one of the most (inaudible) in promoting this approach, is now coming to the realization that they carried the principal too far, and there are a couple of professors at the Harvard School of Business who are now working to undo some of that discounted cash flow analysis and cost benefit ratio development that has grown up over the last quarter of a century.

We never did that in NASA, and we refused to do it when the Congress or the fear of the budget asked us to do it.

The argument, of course, is that you ought to be able -- if you're going to spend money on research at the front end, you ought to tell people what it is going to be good for.

The problem is that you can't quantify the benefits. The benefits sometimes come out in (inaudible) and the application that the research finds is sometimes entirely different than that which you initially intended it to be, but the results generally are good and beneficial, and, therefore, you want to do the research.

In this day of capital shortages and high cost of capital, it is almost impossible to justify a research project on a discounted cash flow analysis basis. Nevertheless we know that if you stop the research, and if we don't do the appropriate research and development into the future, we will end up without a future.

So we opposed that. We attacked it at the time. It is still an ongoing argument every year, as we know through the budget cycle with the Congress. It is led by men like Bill Proxmire and Les Aspin in the Congress, although there's a whole school that works around a minority, I should add, unfortunately so.

But Webb and the program did develop the technological program that attempted to push this up. We have expanded on that, as a matter of fact since I've come to the agency we've expanded even more because we feel in the United States having fallen behind and become noncompetitive in a number of industries, we need to get our technology out to a broader customer base, and we have invited and continued to invite once every quarter the Fortune 500 companies, and that is a euphemism.

We really had invited a group of about 1,000 companies who have expressed interest in our programs to come to one of our research centers and they spent two days and during that two-day period we outlined for them what we are up to, what we're doing, our latest results and encourage them to make use of them and to come back and get more deeply acquainted with the R&D work that we're doing.

They do. More and more of them are doing that, but we were outside of the normal industry that we work with, the aerospace people. We have a number of companies now coming in that will use the research centers and who are benefiting by their results.

So finally in 1969 in July three men race for the moon, and my nation's heart beat faster and I think the world, the whole world thrilled as two of those men,

Neil Armstrong and Buz Aldrin landed on the surface of the moon on July 20 of that year, completing a project for all intents and purposes, we cannot at that point (inaudible) and say, "Well, it's over".

Actually we flew it five more times, 12 men walked on the moon, and the last of those flights, Apollo 17, we actually took a working geologist to the moon, who now happens to be a United States Senator, Senator Jack Schmitt.

We're still analyzing the results of the program. Cost of the program was $23 1/2 billion, a figure that was pretty close to what was predicted in the beginning.

The -- I think the program certainly had an enormous effect on the world. It broadened their horizons, and it showed us once again that if we wanted to we could do these enormous complex and important things, that it opened their eyes to the solution of major problems on earth because we saw that we had a vantage point in the high ground of space to understand better some of the environmental problems, indeed, some of the resource problems that we have, and we are building on that even today.

It has spawn a number of new industries, and it continues to spawn a number of new industries, and it

did, I think, make the nation's economic system more importantly aware of the importance of cooperation between government, the academic community and our industry.

It was true partnership. Where do we go from here? Well, you've seen our shuttle, and we now have routine access to space. We will be flying shuttle again later on this month, June 27, and at that point we will declare it operational and start flying payloads for hire.

We have the shuttle fully booked up for three years, and we have people standing in line waiting to go on the shuttle in the following three years. The program of exploration will continue. We will continue our planetary program.

The next major flight will be in '85, using a probe into the Jobian atmosphere -- Jupiter with an orbiter, and a probe into the atmosphere. Then probably at the end of the decade going back off into Venus to map the surface of Venus, to try to understand a little better how Venus developed because we discovered that Venus was really a sister planet, and which should look a lot like us -- is a great deal different.

It developed in a different way, and we'd like to know why. Beyond that in 1985 with the launch of the large space telescope, and it will allow us to peer out

in space seven times further than any earth based instrument. It is perhaps the most important instrument that man has put into operations in the last couple of hundred years, because it will begin, I think, to tell us how the universe originated and perhaps give us insight into whether there are, indeed, other planetary systems and there very likely are floating around other suns in the near vicinity.

We will continue to develop the applications, the most recent one is the earth's resources satellite, which are giving us great insight into automatic resources on the surface of the earth.

We will be launching still another one this year, which will give us more data and through a broader spectrum which may enable us to understand better where mineralization occurs on the earth.

It will enable us to manage water resources a whole lot better and do a whole lot of mundate tasks such as mapping and just land management activities.

The program goes on. It came about, I think, because of a challenge. We developed it through a period when we were feeling our way through the way management should operate in that kind of an environment.

It has matured, I think, quite well. The nation, and, indeed, the world has, over a period of time

I think become a little jaded on the program. They now take it for granted to a great degree, but I am pleased that in recent years, the last -- at least the last couple -- the public in the United States is taking a great deal more interest in the space program and in the research and development activities that it represents.

We have found that we're no longer as competitive as we thought we were, and I think we're coming into the realization that programs at the cutting edge of technology are extremely important in maintaining our competitive edge.

I think more importantly than that it is summed up in a little (inaudible) which goes something like this, "We shall never cease from exploration and the end of all our exploring will be to arrive at where we started and another place for the first time."

Thank you very much.

(Applause.)

MR. : Thank you very much, Mr. Beggs. I hope to allow to ask --

MR. BEGGS: Of course. I may have overrun my data.

MR. : I think one of the many things that you said that applies to business world is project selection and allocation of resources. The

work you referred to, I think about DCm is the (inaudible) work. Just appeared to be reviewed, of which the course members have a copy of the summary of that work.

(Inaudible) -- apply in theory and the thing that worries me about that, although I can see many of the arguments emotionally to support this -- the new technology (inaudible) is that in NASA the government objective was laid down externally to the organization.

Then the matter of the most effective way of getting to that goal and objective and subgoals and objectives ought to be laid down within the organization.

The private sector company -- starting at the beginning of that process -- they might decide that rather than spending $25 billion for the moon, it would be better for them to put that money on deposit with the bank.

That is a decision that every industrial company manages to face. It has to have some form of mechanism, the choosing between quite radical alternatives, which you didn't have.

Could you talk a little bit about -- around that?

MR. BEGGS: Well, yes, sure. It is -- I realize there are a number of parallels, a number of very major differences between what you do in a government

agency like NASA once you're in business. I spent most of my life in the business world, and wrestled with problems of how do you decide where you're going to put your money.

The similarities, however, are important. Both are -- both business and agencies such as NASA are involved in mission-oriented activities.

In the business world you're after either a product or a service, and are seeking to make that product or service as competitive in the real world as you can, and to maintain continuity in an organization so that you can generate a cash flow sufficient to allow you to continue to operate and grow.

The same, I think, is true of the government agencies. The question that you get to is really what is the proper role if you (inaudible) -- what can I afford to do, how far can I carry it, and what do I -- what can I invest in order to try to build it into a new product area or a new business area.

My problem with this kind of cash flow analysis and the cost benefit kind of approach is that at the front end of research you're never sure where it is going to end, never sure where it's going to go, and as a consequence you'd be trying to assign values to that -- you're probably going to be wrong.

You're going to either overestimate or underestimate. I would argue that there's a proper amount for a business to allocate to their research and development work that it should be very carefully monitored and very carefully controlled.

I think it should be a disciplined approach. We try to do that in NASA. We try to analyze the research development in a very disciplined way. We still have several mechanisms. One we still have the old advisory committee structure.

We have about, oh, maybe 50 different committees. These are committees of -- composed of private citizens either out of the academic world or out of business, and they are peer groups, and they come in once a year, and they analyze -- come in twice a year and they analyze the research program in a very disciplined way and they say, "Look, that is not good research, or they say it should be emphasized and more money should be put on.

You've got to have that kind of discipline. We work very hard to keep -- what we like to think of or what we describe in the United States as hobby shop work.

We try to keep the hobby shop work out of our laboratories. I think that is important for industry,

You apply a very disciplined approach. Again I've argued that the financial analysis that have been applied over the last -- particularly the last decade are probably counter-productive.

If you look at the Japanese experiment, one we've all been studying very closely, the Japanese will put money -- if they see a growth market, right now they're going after a fifth generation of computers.

That is being sustained by government grants, about a half a billion dollars (inaudible) -- they're doing that I am sure, not having doen the cash flow analysis of it nor having done a cost benefit ratio analysis.

They're doing it because they believe that is where the growth is going to be, and they could capture a significant position in that growth market, and that they will do very well, because they've done very well in every other area that they've gone after in a similar fashion.

They don't -- it is interesting when you look at the Japanese system, there's very little of the kind of financial analysis we do in the west that is applied over there.

They do look at the cost, and they always ensure that there's competition within the country. Other than that the most important factor to them is whether there is a growth market to go after.

I think maybe that is what we ought to be looking at. Unfortunately, in the west, I think our tendency too often has been to try to preserve the dying industry.

We throw more money at dying industries. We just did it in the United States -- threw money at Chrysler. (Inaudible) and we look at growth markets to about (inaudible) -- assuming some bright entrepreneur will come along and maybe he will.

We've been fortunate, I think, in the past that we've had many of these kind of people who have worked the system.

My argument is that if you put a dead end on the process with the detailed financial analysis that we would like -- did I get at your question?

MR. : Yes, you did.

MR. : I would like to suggest that there is an analogy and the use of the word entrepreneur is the analogy -- what, in fact, the government says, whether it permits a research budget to go through (inaudible) -- you have the conviction of an entrepreneur.

We share those convictions. We will give you some money, and the entrepreneur, when he or she decides to go into a project, believes that it is valid, and that is all. They may come up against cash flow problems if they're wrong, but their belief is maximum.

I think that kind of commitment approach t hat here is an area that is worthy of being pursued is perhaps the right model for research of the kind that NASA has done.

May I ask a question, however, about your procurement policy? As I understand it there are certain aspects of the NASA work that have security implications.

Presumably the triumvir in charge are fully aware of the project and all the pieces of it that need to have industry compete competitively to build, supply or what have you, and that by breaking down the project into separate procurement policies and procurement areas, you are able to maintain security, and that is clearly advantageous if true.

Once you've broken down the project into a specific procurement policy, and that results in a contract that you put out to tender, have you, in your experience found a way of doing that which gets the necessary standards that clearly NASA must require for safety reasons if for nothing else.

MR. BEGGS: I am not sure. First of all the agency is by and large an open agency. We do work that is classified in the sense of military classification only at the request of the military.

They use our wind tunnels and they do do quite a lot of detailed work in the development cycle in solving problems, using -- that, of course, is classified.

Our own work that we're responsible for is in the open, and that is by design and by law, that it would be an open agency to publish -- we don't take on work in our budget unless we can publish the results, and almost with the exception of something that occasijnally comes up which has an obvious military application, where we will give it to the military, and then they put on a classification.

All the other work is published and it goes out. There's currently some argument in the United States system as to whether that ought to be so, whether we ought to publish as widely as we do. The feeling is that a lot of it gets into the eastern bloc and helps them more than it does the openness of the program.

I don't believe that, but nevertheless that's an argument.

With respect to the procurement side of it though, the system that we have set up is we don't hire systems of managers as the Department of Defense does. Department of Defense will hire a contractor and nominate them as systems manager, and they're responsible for every aspect of the program.

NASA does it differently. We decide early on that we would be the systems manager, and we'd have the necessary capability to do the systems management jobs.

A lot of what I spoke of on remarks as to the early days of organizing and reorganizing, that Jim Webb did, and we continue to do, which is we're trying to perfect that system management process.

It was a trial and error kind of thing. There were a lot of changes -- moving people back and forth in the new areas in order to try to adjust the talent we had to the problems we were facing.

Therefore, the procurement process we employed tends to break the job down, and do into its constituent areas-- and advertise each one of those as the -- and then make them a part of the system team, all reporting into one of the NASA centers.

NASA -- the center then is charged with the responsibility of managing the project, and the oversight responsibility for that center is at headquarters in Washington.

The result of that system has been, I think, largely good. We've ended up, I think, doing -- being able to do the job, and we don't run into the kind of problems that the DOD has run into of getting themselves

into very rapidly escalating budgets and then facing cancellations.

We've had relatively few cancellations in NASA. One other point though. We never, in NASA, succumbed to the pressure of the Congress to let our contracts on a fixed price basis, as did the DOD a couple points in their cycle.

The -- all of our contracts are either on a cost reimburseable basis or on a -- if it is a fixed price, it is a fixed price incentive, which is a flexible -- I don't know whether that term means anything to you, but it is a flexible arrangement with our contractors, so that the contractor never is in a position of being driven to the point of losing significant sums of money on the research and development projects that he is involved in with us.

That has served the agency well, and it continues to this day. We try to -- we continue to experiment with incentives that we can put on those contracts to, and I think about the best one that we have come up with, best one -- one most widely in use is the use of an award fee.

The award fee is a very subjective kind of thing, in which a board sits down and grades the contractor as to what kind of job they think he did. Then he gets

-- there is a pool, and on -- you were given a certain percentage of that depending on the grade he gets.

Some contractors have a great deal of trouble with that because they don't like the grades they get.

(Laughter)

Others have trouble with the concept because they feel it is too subjective. It is not objective enough to where they can say, You know if I do -- if I get here and if I spend this much money, and if I accomplish this task, I will get so much profit.

They can't do that under that system, but for our research and development activity, which is what we're involved in, in about 95 percent of our work, it probably is about the best that you can come up with, although we're still experimenting with other types of incentives to reward superior performance.

MR. : Could I invite you to comment on the way in which the powerful group of three people operated? What did they bring to the group? I think you described them as three heads on one body, and if their contribution was similar -- what are the different roles that they had?

MR. BEGGS: Yes, they were very definitely -- first you have to understand the three men -- Webb was the guy who had quite a lot of experience in government.

He served with the Congress, staff of the Congress when he was quite young. In the Truman Administration he was Director of the Budget, and later on was Undersecretary of State, which in the American system is the number two position in the State Department.

He then went out to the industry and worked for Kerr McGee. Worked for Sperry Company, so he had had fairly wide experience in the industrial setup.

Dryden came out of -- a creature of the civil service, United States Civil Service. He's grown up through the Bureau of Standards and then NACA. He was the head of NACA when NASA was created and so he was kind of engulfed in the agency.

All his experience was as a government bureaucrat.

Semens' experience was his academic -- he was a university professor. He had had some industrial experience, and having worked for RCA as a research engineer, so they came from somewhat different backgrounds and they brought different talents to the job.

The Division of Responsibility between the three -- Webb handled all the outside activities. He was responsible for having relationships with the Congress. He did most of the leg work with the White House and with the rest of the government, and there were

a large number of interfaces with other agencies with government in the program.

Dryden was the inside manager, and was primarily responsible for the personnel activities. Hugh Dryden was a very, very impressive man. He -- his major talent, I think, was an ability to judge people.

He could -- as Webb would say, "see right through a man" -- he could. He was excellent at picking the right men.

Semens devoted most of his time in program management, with keeping the program moving, and so you had a sharing of the management responsibilities, I think, in a very effective way, since their backgrounds could be applied very effectively in those three roles.

But as I said in my remarks, when major decisions had to be taken, they were taken by the three in concert. What that projected out through the organization was that when they announced that we were doing something, that the agency was going to go forward and what the decision was, everybody got behind it.

It was a new -- if they fought it they were going to have to fight all three men, and one of those three was almost usre to be on top of anybody in the organization anywhere.

It was very effective, and worked well, and I think probably because of personalities and background of the men, and the fact that they did share the responsibility.

After the fire the thing fell apart. That particular system fell apart, and the reason it fell apart was that Dryden was dying. He died just a short time after the fire, and Semens, because of the fire, developed a strained relationship with the other two.

The other -- I think he probably felt more responsible for the fire, and I think probably because of that he -- the relationship between the three changed drastically after the fire.

The organization changed to signifcant degrees after the fire. Bob Semens left about a year after that, and as I say Dryden died. Webb then moved Tom Payne who became the subsequent administrator to take Dryden's place, still operating with basically the same principals of management, and the general manager was never replaced -- Bob Semens was never replaced.

Instead of that Webb went to a more participative, as he called it, style of management, in which he used the four associate administrators in that period which I was one.

One for manned space flight. One for advanced

research and technology. One for space sciences and one for applications.

Those four used to sit together with Payne and Webb and perform moreless the same function of the three -- that they performed before.

I think if you -- the success of that style of management really depends on the ability of the man to share responsibility. Some men can't do that. Webb could. He was -- I think uniquely qualified to run a system like that, and I don't think there are very many men that could run quite the kind of system he ran.

It worked very well for him. I guess what it teaches is that there really -- you can put the right team together. You can run a very effective system in a number of different ways.

They chose that way, and I think it was very effective in a government environment, because it -- it gave the Congress a great deal of solace that there were several men responsible men who were working the problem, and that the problem was under control at all times.

There was another hallmark of it. It was by far -- there were -- Semens was a Republican, Webb was a Democrat and Dryden was a neuter.

(Laughter.)

And they could go up and talk to any Congressman of any pursuasion and they understood where they were coming from. They were coming from questionable (inaudible) --

MR. : If I could understand something that (inaudible) -- I am probably the only person who has had a long conversation with Jim Webb, but you've described him correctly -- he didn't have scientific training did he?

MR. BEGGS: No.

MR. : But he wasn't -- he really did seem to me to be an entrepreneur because when I talked to him, when he just left NASA, he said he'd spend his retirement assisting other people and setting up very entrepreneurial differences.

MR. BEGGS: Yes, He was inclined in that direction. He was trained as a lawyer but he never practiced law. He spent a lot of time in industry and he did have an entrepreneur -- spent the last 15 years of his life assistning in entrepreneur ventures.

MR. : Could I ask a question about another group of three -- group of three that are going up. They obviously had great many talents in common, and yet somehow your framing of them finally decided who was number one.

I am not sure whether you said number one, two and three, but if I understand from television programs is that they're number one.

Do you care to -- well, we've been talking all this week really abour rarest types of leaders -- different types of leaders there, and these men were presumed your leaders in their own right.

Yet somebody had to be boss, and somebody had to decide who was going to be boss and so on.

Do you care to comment?

MR. BEGGS: Well, there was set up early in the program a very detailed and excruciatingly complex system of picking those crews. The first problem they faced was that -- of course, everyone wanted to fly first and everyone wanted to go to the moon, but the time we went to the moon, there was, I think, 37 astronauts waiting, and since we only flew three times only 18 could go, and as a matter of fact a couple of them flew twice.

In actual fact, I think 15 16 went and 12, of course, walked on the moon, and the screening process -- have to screen out those who would be landing crew, and one who would stay at home to man the buddy ship that would bring them back, and then it had to decide who was going to be the commander and how the system was going to work from space.

The first decision that was made was that prime control would remain on the ground, and any decision on either an emergency crisis or changed plans would be made at mission control in Houston by the man who was in charge of the mission, who was a specific individual.

It finally boiled down to being Chris Craft, who was the mission control director, but the major decisions were made by Bob Gilrude, and then were -- could be second-guessed by George Miller, who ran the office in Washington or by the trimvur we spoke of.

The major decision work were ground decisions. The training program was so constructed so as to try to bring out leadership in the astronauts. They were graded all the way through, and the ones that showed the greatest talent for leadership became the pool out of which we selected the command balance, and that was the Neil Armstrongs and the Frank Bormans and that group of men.

As time went on and that group became seasoned, almost any of the 37 astronauts could have been a command power, and the decision really was as between the best of a very big group, and it was done by various careful grading processes.

We graded them on everything, and the folks that did the best were the ones who were selected as command balance and the others came in behind them.

It is relatively easy though when you look at that group to pick out the leaders. In fact, I think if we were to take this group down to Houston -- they're now set. We now have 78 in training because we're planning to fly a lot, and we'll be flying five times next year and then ten times the following year, so we'll be flying -- and then build that up to 18 the following year and then up to 24, so we'll be flying two men for the first series of flights, and then four as we carry more sophisticated payloads in space, and we'll need mission specialists who are trained on a specific payload.

So we're going to need a lot of -- we do have 78 in training, but if you take this -- I took this group down there, and I said now, "Let's expose you to the group of 78 for two days." You'd be able to pick out the ten best in two days if we showed you everything they were going to --

The best one I ever saw -- the best one as far as I am concerned though, when I was associated with that program was Armstrong. He was absolutely superb as a pilot, but you've got to remember a command pilot is a different can of worms than the kind of leadership that you're talking about here, business leadership.

What you're looking for is someone who has got a very cool approach to life who moves quickly in an

emergency, who thinks clearly in an emergency, and Neil could do that to a superb extent.

One of the Gemini flights where he was command pilot -- I forget which one it was -- it was the one where we had trouble with it -- had an amusing story about that goes with that mission.

Neil was in orbit and we were going to bring them down at the exact time that a dinner was supposed to conclude in Washington, and the speaker of the dinner was Hubert Humphrey, and Hubert, as you know was a speaker who could speak extemporaneously forever, but --

(Laughter.)

But at any rate he was the Vice President at the time, and he was the featured speaker, and we were going to conclude his speech. We had a whole thing ready -- we were going to conclude his speech by passing some message up to him that the Gemini capsule had been recovered in the Pacific, and the mission was a success.

Well, we had an emergency and one of the (inaudible) rocket systems malfunctioned. Neil had, I think, it was 14 seconds to react to that problem or we would have lost the mission, and he did exactly the right thing, exactly the right thing.

As (inaudible) would allow we had to go around one more time. We spent 90 more minutes, so we

passed the message up to him --

(Laughter)

We said, "Mr. Vice President, we have a little bit of bottle gas to go around one more time. You either have the option of concluding your speech and explaining the problem or you could continue as you wish."

Without even causing in mid-sentence he went on and spoke for 90 more minutes.

(Laughter.)

I think Neil would not make a good businessman. He's teaching school out in Cincinnati now, and that is his choice. Didn't want to go into business.

MR. : What type of school?

MR. BEGGS: Excuse me?

MR. : I said what type of school?

MR. BEGGS: University. He's a tenured professor now, teaching -- he was -- Neil was a civilian. We didn't get him out of the military. He was out of the old NACA program. He was a test pilot flying experimental airplanes out at Edwards Air -- Rogers, out in California.

He was a trained aerodynamicist. That was his training. He became a test pilot, and was a very good test pilot. We picked him up as one of the original group, and he decided he wanted to come back out there,

and as far as I can see did a fine job. He would not have been a businessman, but he's a superb command pilot.

MR. : How would you rate the crew of Appolo 13?

MR. BEGGS: Well, obviously, the crew performed very well under very adverse conditions. That particular mission -- how much time do I have, sir?

MR. : Five minutes.

MR. BEGGS: Five minutes? Let me talk just briefly about Appolo 13. As you all know 13 was the disaster, or almost near disaster that we had. It confirmed my triscadechaphobia (phonetic). The -- what we had done prior to 13 was to change a number of things.

We kept tinkering with this thing, which in retrospect was not a smart thing to do. We kept tinkering with the system as we flew these missions, and after 13 we quit doing that because we learned that that was not a good idea.

We have a number of new systems. We could change a number of the subsystems because of problems that we had had in prior ones. We put new equipment in, tested it, of course, extensively, but they were new.

We didn't know as well as we should have -- was the interaction of all of this new subsystems, and as a consequence we did have an explosion, and we lost

the main part of the mission, and we were in a very, very tenuous situation for several days while we worked to get it back.

That particular situation confirms the wisdom though of making the decisions on the ground. I might add that the test pilots who were here all were superb test pilots, fought that tooth and nail.

They said, "Look you've got to -- you hired us because we're the best test pilots you can hire, and now you're not going to let us make any decisions up there, and that is wrong, and we said, "No, that is the way we're going to have to run this program.".

That confirmed the wisdom of that because we were able to set up in the simulators down at Johnson the exact conditions that we have in space. We duplicated the problem, and we were able to work around from the ground in the tunnel, and tell them just exactly what to do, and we got them back safely on shore, because we did have that system set up in such a way that we could understand any emergency and could work it out properly on the ground, and then give them instructions as to what to do.

The crew that was up there was a seasoned crew. Jim Lovell -- Lovell flew again, and did very well. I think they performed as well as can be expected. They

were obviously shaken by that experience, because it was a very tight and narrow thing, and they came on through it.

After that we decided no more changes. I shouldn't say that, not no more changes, but any changes that may -- any changes had to be mandatory on the basis that it was needed for safety or safety flight or a mandatory condition where the mission could not be performed, and as a consequence the changes were reviewed right up to the top after that mission.

We made no changes on the basis, "Well, it is not working quite as well as we would like it to, so let's do it a little better." That is, in my experience, that is always a mistake. If you've got something that is working, as we say down in Georgia, "If it ain't broke don't fix it.".

(Laughter.)

MR. : I am afraid we're going to have to stop. Can I just ask you one question, though, if you're prepared to answer it. You said that Neil Armstrong wouldn't have made a very good businessman in your view.

Could you just tell us very briefly why you think that? What were the characteristics he has that made you say that?

MR. BEGGS: Well, he was very -- not interested

at all in the -- we tried to make a businessman out of him. We brought him up to headquarters and put Neil in charge of the aeronautics program at one point, and tried to give him to run contracts.

He hated reading reports. He hated the financial aspects of it. He hated budgets. He would not get involved -- he loved technology. Loved the idea of going out and getting something new started, but then to manage it in detail day-by-day and to sit on top of the financial reports and the progress reports, schedule reports, just was something that he would not and could not get interested in.

Just wasn't his cup of tea, and he wouldn't do it.

He was -- he's the kind of a guy that if you give him an engineering problem, he'll sit down and work on it until he solved it, but -- and so he probably could have made a reasonably good research engineer in industry, and I think he probably could have probably run a research organization in industry except he had a heck of a time getting into making budgets.

(Laughter.)

MR. : Thank you very much, indeed, Mr. Beggs. We're very -- it was a very interesting talk, and very interesting answers to the questions. We're

delighted that you'll be with us for the rest of the day, and your wife as well, and we'd just like, at this point, to say how much we appreciate having you come so far to talk to us.

MR. BEGGS: Thank you very much.

(Applause.)

(Conclusion of Speech by James Beggs, NASA Administrator, on "Leadership in Exploration".)